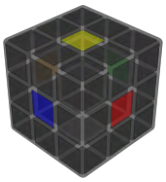
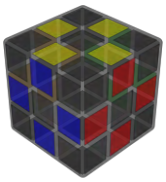
How to Solve a Rubik's Cube – A Beginner's Tutorial

Pieces of the Cube

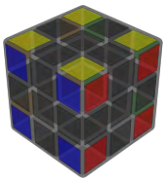
There are **3** types of pieces on the cube:



Center pieces – there are **6** center pieces and they have **1** sticker on them.
They do not move, and therefore determine what color a face of the cube *must* be.
The other pieces are to be solved relative to these.



Edge pieces – these are 12 edge pieces and they have **2** stickers on them.



Corner pieces – there are 8 corner pieces and they have **3** stickers on them.

Notation

A **letter** represents each face of the cube: **U**p, **D**own, **L**eft, **R**ight, **F**ront, and **B**ack.

By default, a letter denotes a **90-degree clockwise** turn of its corresponding face. A letter followed by a "prime" symbol (which looks like an *apostrophe*) denotes a **90-degree counter-clockwise** turn. A letter followed by a "2" corresponds to a **180-degree** turn. Clockwise and counter-clockwise turns are relative to if you were looking directly at the face.

U

L

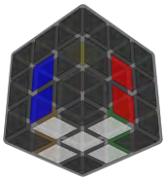
F

D

R

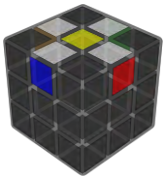
B

Step 1 – Cross



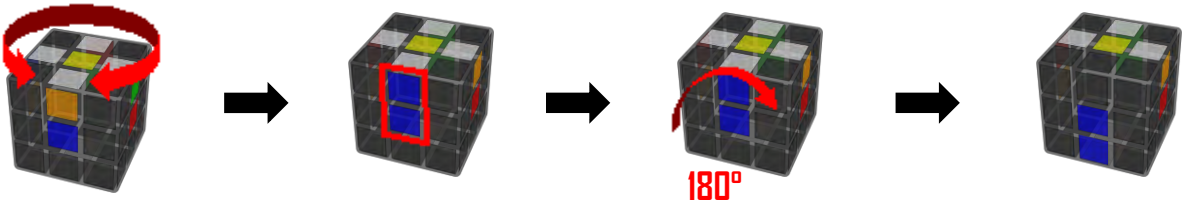
The first step is to create a cross where each piece of the cross matches **both** adjacent center pieces. For instructional purposes, we will stick to building it on the **white** face.

Alt. Step 1 – "Daisy" Cross

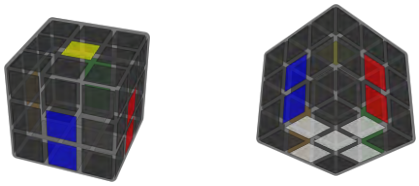


A less efficient, but easier and systematic way to create the cross in Step 1 is to first place the four **white** edge pieces around the **yellow** center piece (forming a "daisy" cross, pictured on the left).

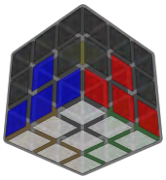
Keep the face with the **yellow** center on **top**. Select one of the four **white** edge pieces, and rotate the **top** face until the piece lines up with a center piece. Next, face the center that it lined up with in **front** of you (while keeping the **yellow** center on **top**), and rotate the **front** face 180 degrees.



Repeat this for the remaining **white** edge pieces around the **yellow** center to complete the cross.

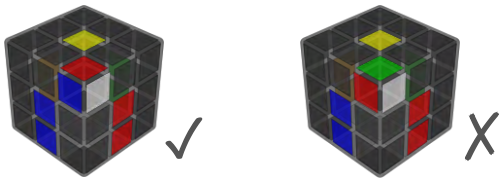


Step 2 – First Layer

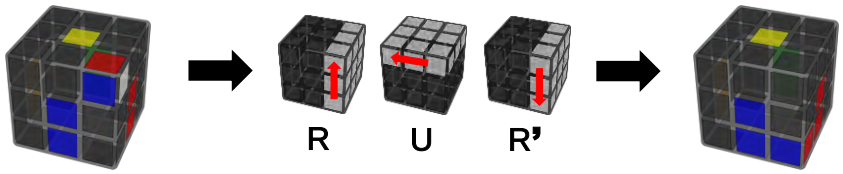


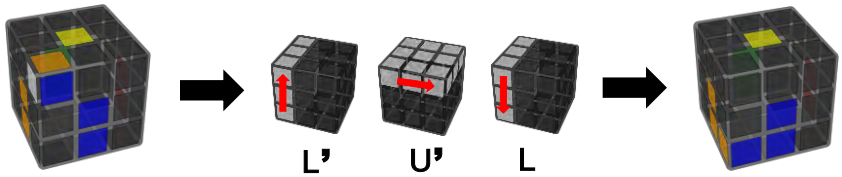
The second step is to complete the first layer of the puzzle. This is done by inserting four corner pieces around the cross created in Step 1.

Keeping the **yellow** center on **top**, try to locate a corner piece that has a **white** sticker along the **sides** of the **top** layer. Use the other two stickers on this corner piece to locate where the piece belongs, and rotate the **top** layer until the piece is above this location.

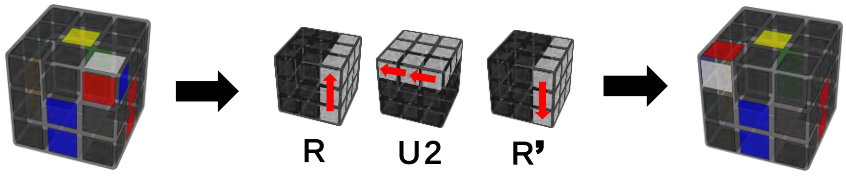


Use the following sequences (or *algorithms*) to insert the corner depending on the location of the **white** sticker.

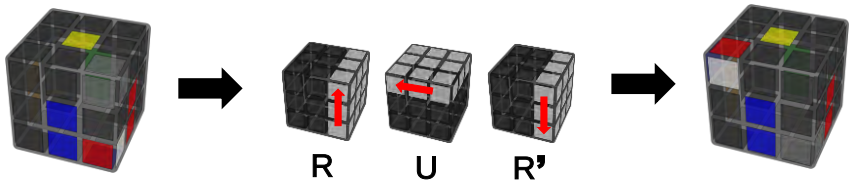




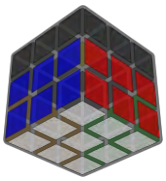
If the first layer is not completed and there are no **white** stickers along the **sides** of the **top** layer, it is possible that a first layer corner piece has a **white** sticker facing **upwards**. Position the corner above where it belongs and perform the following algorithm to change the location of the **white** sticker.



It is also possible that the first layer corner piece is in the first layer, but twisted the wrong way. Use one of the above algorithms to insert **another piece** into its location. This effectively kicks the piece out of the first layer, allowing for it to be re-inserted the right way. For example:

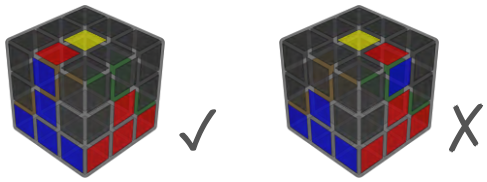


Step 3 – Second Layer

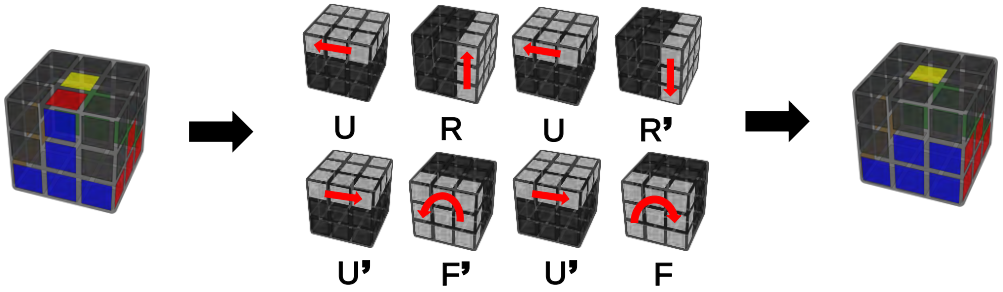


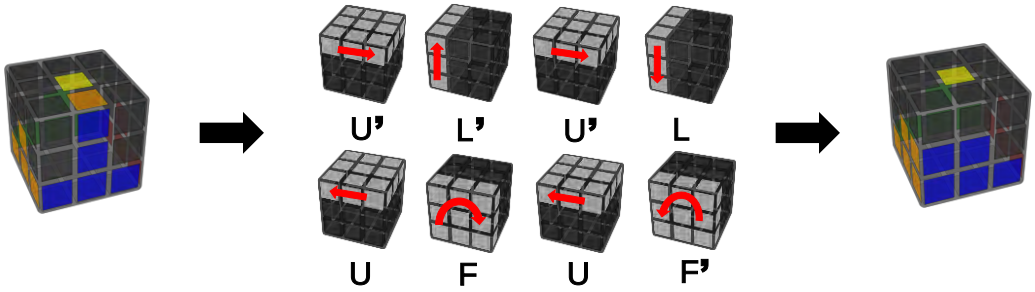
The third step is to complete the second layer of the puzzle. This is done by inserting four edge pieces above the corner pieces inserted in Step 2.

Keeping the **yellow** center on **top**, try to locate an edge piece in the top layer that does **not** have a **yellow** sticker on it. Rotate the **top** layer until the side sticker on this piece lines up with a center piece.

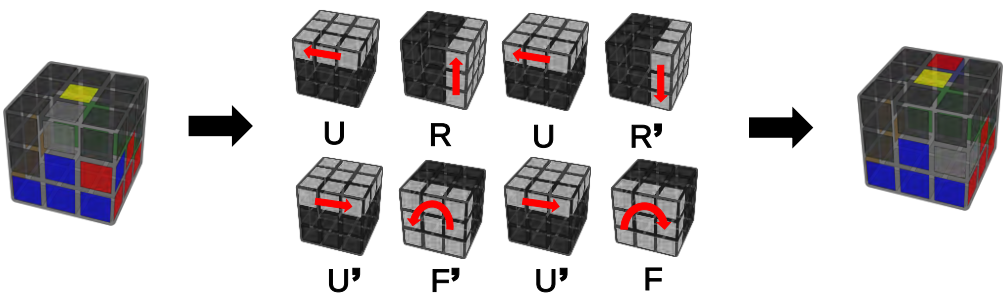


Use the following algorithms to insert the edge into the second layer based on where the piece is to be inserted.

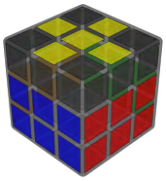




If the second layer is not completed, and there are no edge pieces **without** a **yellow** sticker in the **top** layer, then it means the piece(s) you are looking for are in the second layer, but not in the right location(s). Use one of the above algorithms to insert **another piece** into its location. This effectively kicks the piece out of the second layer, allowing for it to be re-inserted the right way. For example:

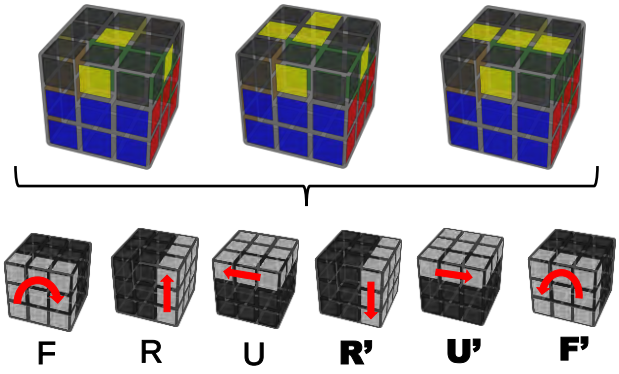


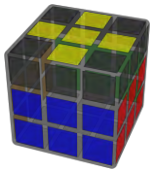
Step 4 – Orient Last Layer Edges



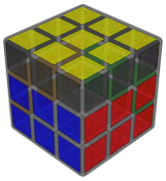
The fourth step is to orient the edge pieces of the last layer. That is, to flip them such that all edges on the **yellow** face are facing the right way, effectively making a **yellow** cross.

Keeping the **yellow** center on **top**, depending on how many edges already have their **yellow** sticker on top, face the cube as pictured below and use the following algorithm to orient the remaining edges. You may have to **repeat** the algorithm up to 3 times to orient all the edges.



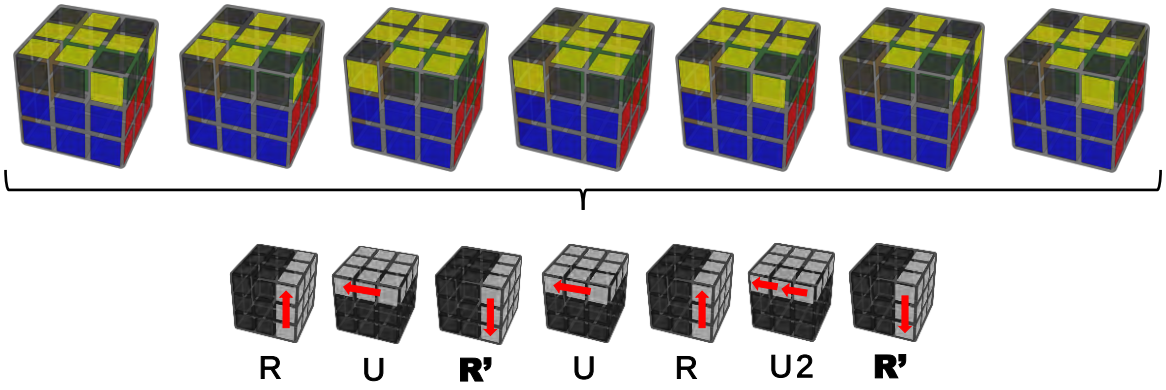
Repeat until: 

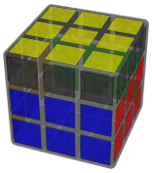
Step 5 – Orient Last Layer Corners



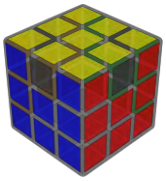
The fifth step is to orient the corner pieces of the last layer. That is, to flip them such that all corners on the **yellow** face are facing the right way, making a solid yellow face.

Keeping the **yellow** center on **top**, depending on which way the **yellow** corners are facing, face the cube as pictured below and use the following algorithm to orient the last layer corners. You may have to **repeat** the algorithm up to 3 times to orient all the corners.



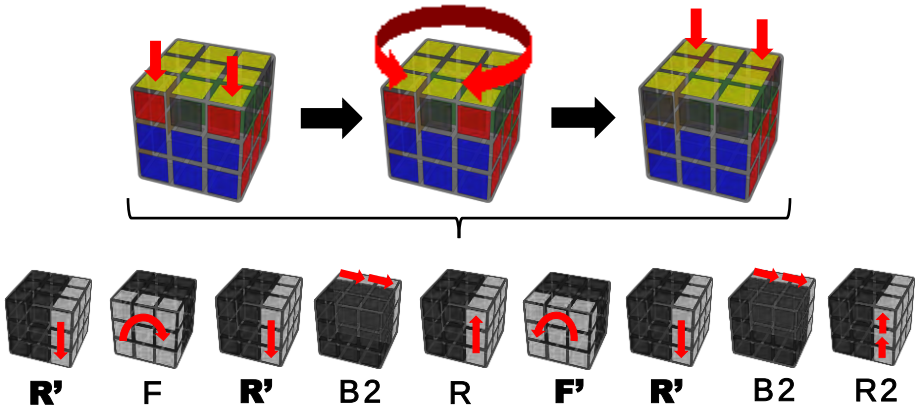
Repeat until: 

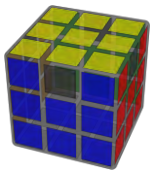
Step 6 – Permute Last Layer Corners



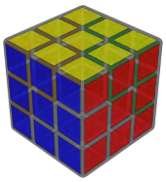
The sixth step is to permute the corners of the last layer. This step will move the corner pieces around into their solved positions.

Keeping the **yellow** center on **top**, try to locate a side of the **top** layer where the two corner stickers **match**. Face this side **away** from you and perform the following algorithm. If there is no side with two matching corner stickers, perform the algorithm below on any side (with **yellow** on top) and repeat this step.



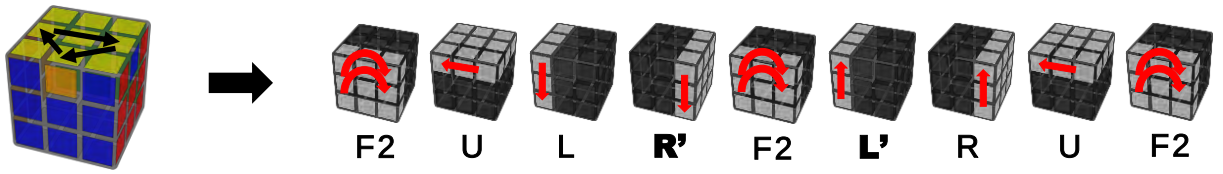
Repeat until: 

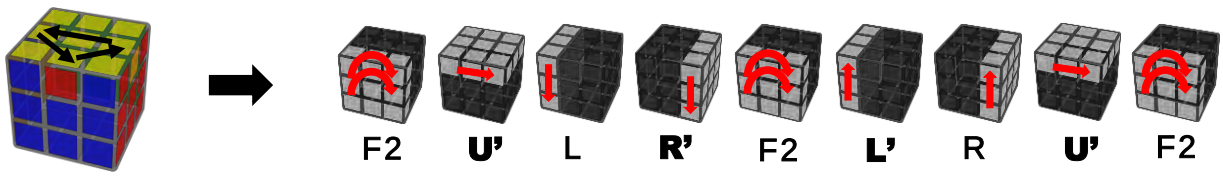
Step 7 – Permute Last Layer Edges

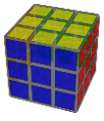


The seventh step is to permute the edges of the last layer. This step will move the edge pieces around into their solved positions, solving the remainder of the cube!

Keeping the **yellow** center on **top**, if only **3** edges are unsolved, position the edges in front of you like pictured below and perform one of the following algorithms depending on which direction the edges need to be moved. If **4** edges are unsolved, perform any of the following algorithms on any side (with **yellow** on top) and repeat this step.





 Done!